Vol. 84, No. 43, pp. 359–370 29 February 1972

PROCEEDINGS
OF THE
BIOLOGICAL SOCIETY OF WASHINGTON

A NEW SPECIES OF TEMOROPIA (COPEPODA: CALANOIDA) FROM THE SARGASSO SEA[1]

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Since Thomas Scott (1894) described *Temoropia mayumbaensis* from the Gulf of Guinea a few female specimens whose fifth legs differed from those of typical female *T. mayumbaensis* have been reported from the Atlantic and Pacific Oceans. From 630 and 680 fathoms depth off Ireland and also from a 120 to 0 m vertical haul off New Zealand, Farran (1908, 1929) obtained several such specimens. Andrew Scott (1909), who found only typical *T. mayumbaensis* in his samples collected in the Pacific on the Siboga Expedition, recognized that Farran's North Atlantic specimens represented "a nearly related species." Farran (1936) finally obtained typical female and male *T. mayumbaensis* in the Great Barrier Reef collections, and then noted that "There seem to be distinct differences, probably of specific value, between the fifth feet of the various forms which have been recorded under this name." In many instances, references in the literature to *T. mayumbaensis* have not been accompanied by figures or descriptions, but typical *T. mayumbaensis* has been documented from the Pacific by A. Scott (1909), Wilson (1942) and Grice (1962), from the Gulf of Guinea (Vervoort, 1965), from the Cariaco Trench in the Caribbean Sea (Legaré, 1964), and from the North Atlantic by Wheeler (1970, Figs. 67–70), who figured females not only of *T. mayumbaensis* but also of *T. minor* new species (Figs. 71–75), the species here described, and noted that exam-

[1] Contribution No. 527 from the Bermuda Biological Station. This work was supported by Grant GB-15575 from the National Science Foundation.

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ination of more specimens might lead to the separation of the two types.

Undocumented *T. mayumbaensis* has been reported from the Atlantic and Indian Oceans from samples collected over a wide depth range between the surface and 4,000 m. It was first recorded from the northwestern Atlantic by Grice and Hart (1962). In the South Atlantic off Brazil, Björnberg (1965) noted that it was most numerous from 100–300 m, but present in samples from 300–500 m and from 500–1,000 m depths. Cervigon and Marcano (1965) recorded its numbers year-round at several depths down to 500 m, and considered it typical of the intermediate levels of the Cariaco Trench. Grice and Hulsemann (1965, 1967) list *T. mayumbaensis* as a contaminant below 500 m, and in their 1965 paper do not give the hauls in which it was present, but Wheeler (1970) states that they "found eight individuals above 1,000 m compared to 46 specimens in tows closing below 1,000 m in the North Atlantic"; they recorded *T. mayumbaensis* in samples from 14 stations in the western Indian Ocean, which were collected over a total depth range of 3,000 to 750 m. Park (1970) listed this species as present in samples from two stations in the Caribbean Sea over depth ranges of 0–500 m and 487–1,900 m. It has also been recorded from the Florida Current (Owre and Foyo, 1967). Hure and di Carlo (1968) found *T. mayumbaensis* rare in the Gulf of Naples, but it was one of the most important bathypelagic forms in their 900–0 m samples at a station in the southern Adriatic near Dubrovnik. Wheeler's (1970) samples, which contained females of both species of *Temoropia*, were collected with closing nets between 2,000 and 4,000 m in the North Atlantic.

Judging from the published collection data, the overall possible depth range of verified specimens of *T. mayumbaensis* is from the surface to 4,000 m. It has been reported from samples collected 0–100 m (Wilson, 1942; Vervoort, 1965), 0–150 m (Grice, 1962), 0–500 m (Legaré, 1964), 0–600 m (Farran, 1936), 0–1536 m (A. Scott, 1909), and 2,000–4,000 m (Wheeler, 1970). *T. minor* new species as evidenced by published figures of the female fifth legs, has also been collected from the upper 120 m in the South Pacific off New Zealand (Farran, 1929), from 630 and 680 fathoms depth in the North Atlantic off Ireland (Farran, 1908), and from between 2,000 and 4,000 m in the Atlantic (Wheeler, 1970). Both species appear to have a wide depth range.

In a study of monthly plankton samples collected over four depth intervals between the surface and 2,000 m at Station "S", 32°10′N, 64°30′W, in the Sargasso Sea off Bermuda, specimens of *Temoropia* have been found year-round in small numbers throughout the 2,000 m water column. Since Grice and Hulsemann consider *T. mayumbaensis* a contaminant below 500 m, and since specimens of *Temoropia* were present in almost all the quantitative counts over the entire water column, special attention has first been centered on *Temoropia*, although many other taxonomic problems have also been encountered. The first most noticeable fact was a difference in size, the specimens from the upper waters being much larger. The larger specimens proved to be typical *T. mayumbaensis* Scott. The smaller form, *T. minor* new species, is easily distinguished from *T. mayumbaensis* on the basis of size, the shape of the rostrum, the fifth legs of both sexes, and the symmetry or asymmetry of the female genital segment and fifth legs.

Temoropia minor new species

Figures 1b, d-f; 2b-d, g, h; 3 and 4; 5b-f, l, k; 6B-D

Temoropia mayumbaensis—G. P. Farran, 1908, p. 59, Pl. VI, Figs. 9–15; 1929, p. 257, Fig. 22.—E. H. Wheeler, Jr., 1970, p. 12, Figs. 71–75 [part].

Types: Male and female paratypes will be deposited in the Smithsonian Institution.

Locality: 32°10′N, 64°30′W in the Sargasso Sea.

Occurrence: Year-round, depth range 500–2,000 m.

Diagnosis: Female: Head rounded, double rostrum wide and short, projecting ventrad (Figs. 1b, f; 2b). Head separated from first thoracic segment, fourth and fifth thoracic segments separate, urosome 4-segmented. Genital segment symmetrical in dorsal or ventral view, much swollen ventrally, lacking spines (Fig. 2c, d). Exopodite of second antenna slightly longer than endopodite and of approximately 8 segments (Fig. 3a). Cutting edge of mandible with 8 points (Fig. 3c). Proximal lobe of first maxilla strongly spined (Fig. 3e). Second maxilla with 7 lobes bearing 1, 3, 3, 3, 3, 3, 2 setae respectively (Fig. 3b). Maxilliped

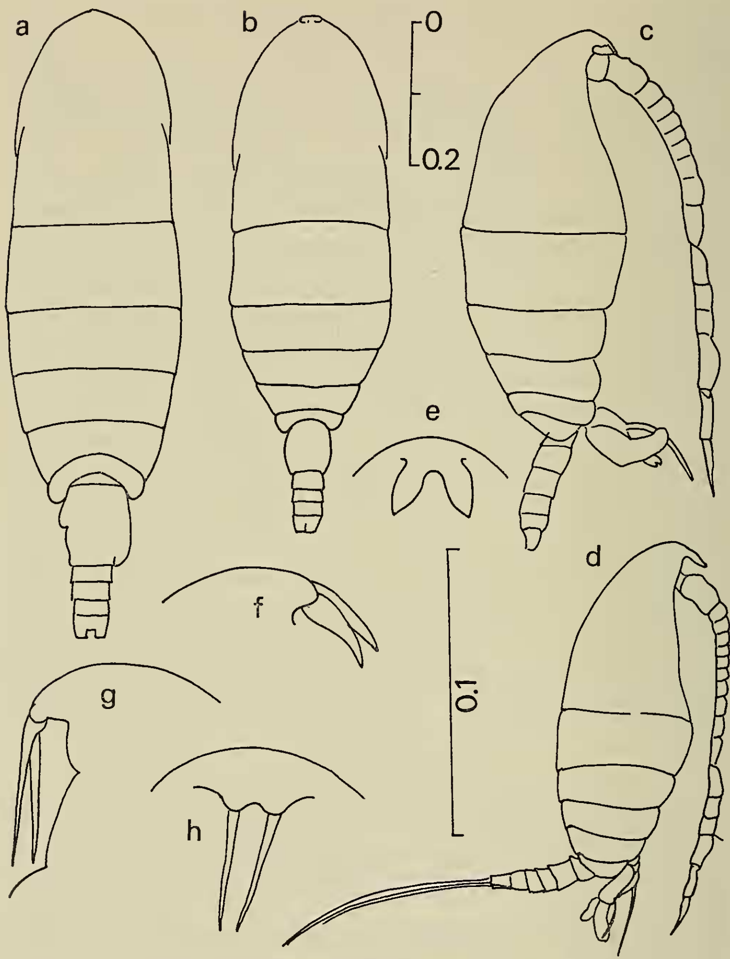

FIG. 1. a, *Temoropia mayumbaensis* female, dorsal view; b, *T. minor* female, dorsal view; c, *T. mayumbaensis* male, lateral view; d, *T. minor* male, lateral view; e, Anterior view of *T. minor* male rostrum; f, *T. minor* female rostrum, lateral view; g, *T. mayumbaensis* female rostrum, lateral view; h, *T. mayumbaensis* male rostrum, anterior view. Scale at top for Figs. a-d, at bottom for Figs. e-h. Scales in mm.

with 2 long terminal spines and characteristically shaped basal segment (Fig. 4i). First leg with 2 endopodal, 3 exopodal segments, with several tiny spines on second and third exopodite segments (Fig. 4c). Second to fourth legs with 3 endopodal and 3 exopodal segments, the second and

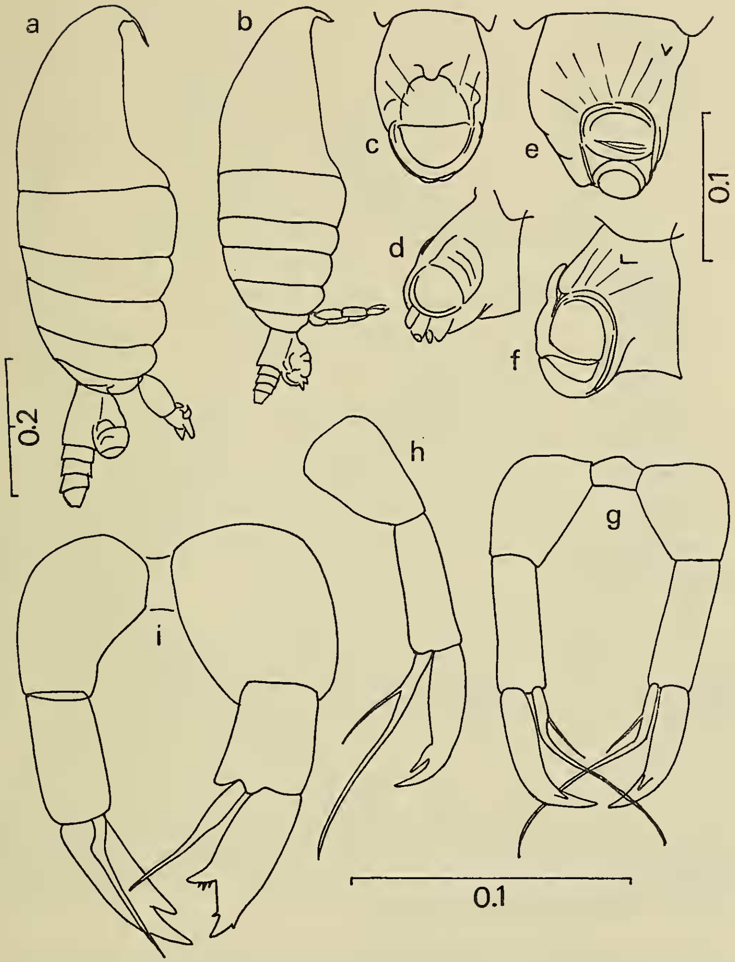

FIG. 2. a, *T. mayumbaensis* female, lateral view; b, *T. minor* female, lateral view; c, Ventral view of *T. minor* female genital segment; d, *T. minor* female genital segment, lateral view; e, *T. mayumbaensis* female genital segment, ventral view; f, *T. mayumbaensis* female genital segment, lateral view; g, Fifth legs of female *T. minor*; h, Another view of female *T. minor* fifth leg; i, Fifth legs of female *T. mayumbaensis*. Scale at left center for Figs. a and b, at top right for Figs. c-f, at bottom for Figs. g-i. Scales in mm.

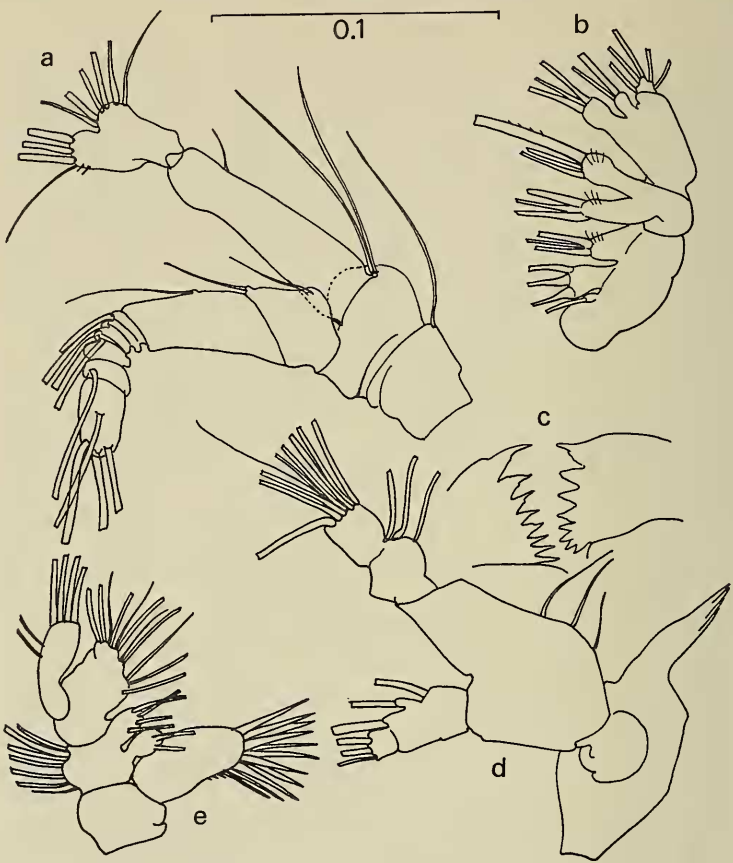

FIG. 3. *T. minor* female. a, Second antenna (most setae cut off); b, Second maxilla (setae cut off); c, Cutting edges of two mandibles; d, Mandible (most setae cut off); e, First maxilla (most setae cut off). Scale at top for Figs. a-e. Scale in mm.

third segments of the endopodite of the second leg not always clearly separated (Figs. 4b, g, h). Spines present on the second endopodal segments, posterior surface, of second to fourth legs, and at least on the second exopodite segment of the first to fourth legs. The strong terminal toothed spine of the third leg curved at tip (Fig. 4h), that of the fourth leg nearly straight (Fig. 4f). Fifth legs symmetrical, of "slender" type (Wheeler, 1970), with 3 segments, last segment forked at tip, longest point external, shorter inner point possibly toothed, long thin rudimentary endopodite (?) present, projecting beyond tip of third segment, forked near its base with a shorter internal seta (Figs. 2g, h).

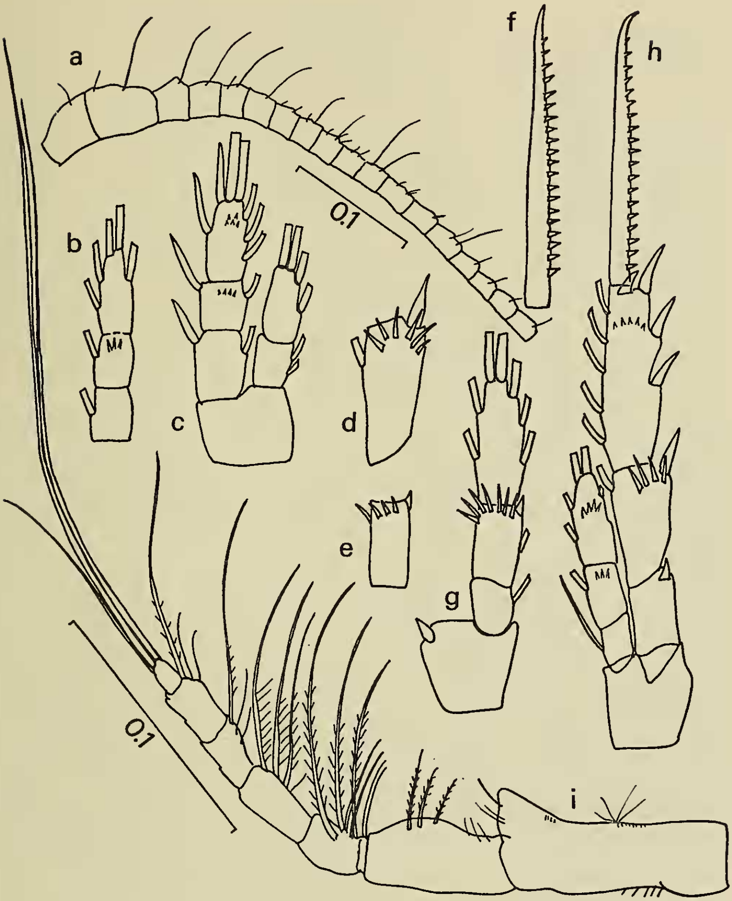

Fig. 4. *T. minor.* a, Male left first antenna, lacking last segments; b, Endopodite of female second leg (setae cut off); c, Female first leg (some spines and setae cut off); d, Second exopodite segment of female fourth leg, posterior surface; e, Second endopodite segment of female fourth leg, anterior surface; f, Terminal spine of third exopodite segment of female fourth leg; g, Endopodite of female fourth leg, posterior surface (setae cut off); h, Female third leg, posterior surface; i, Female maxilliped. Scale below a for Fig. a, at bottom left for Figs. b-i. Scales in mm.

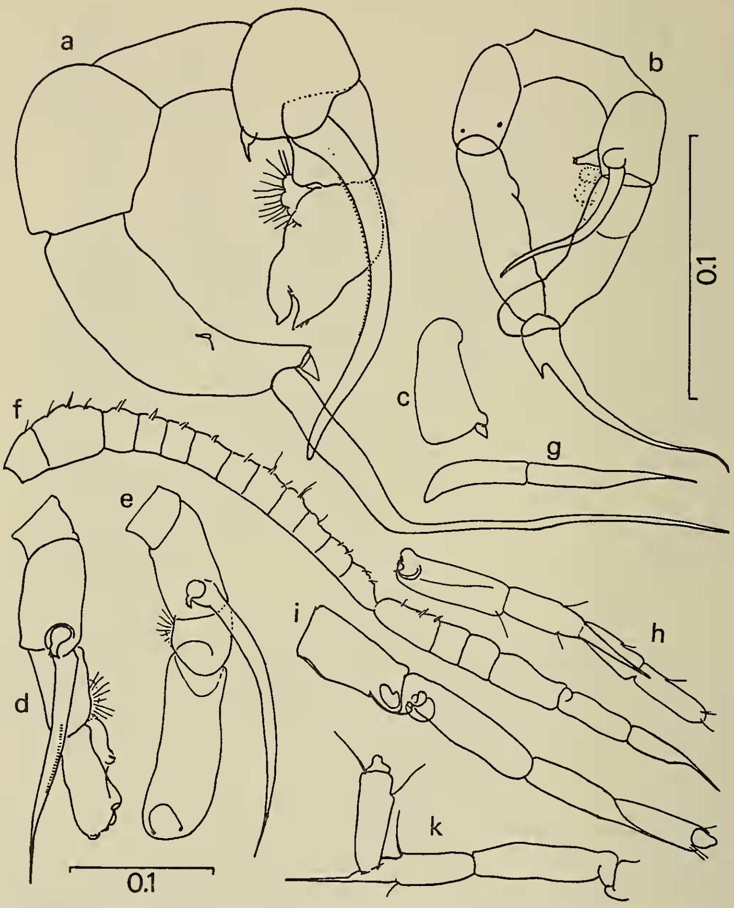

Fig. 5. a, *T. mayumbaensis* male fifth legs; b, *T. minor* male fifth legs; c, First segment of *T. minor* male right fifth leg, showing spine visible in lateral view; d, lateral view of male *T. minor* left fifth leg; e, Inner view of male *T. minor* left fifth leg; f, *T. minor* male right first antenna, lacking last segment; g, Pointed segment near tip of male *T. mayumbaensis* right first antenna; h, Last segments of *T. mayumbaensis* male right first antenna; i, Last segments of *T. minor* male right first antenna; k, Last segments of *T. minor* male right first antenna, last segment partially broken off. Scale at top right for Figs. a-e, g-k, at bottom left for Fig. f. Scales in mm.

Size: 0.67–0.73 mm total length.

Male: Segmentation of body and legs as in female, except that the urosome is 5 segmented (Fig. 1d). Short double rostrum as in female (Fig. 1e). As in the *T. mayumbaensis* male, the right antenna is geniculate, and is constricted between the twelfth and thirteenth and hinged between the sixteenth and seventeenth segments. As figured by Grice (1962, Pl. 20, Figs. 10, 11) for male *T. mayumbaensis*, and as shown in Figures 1c, 1d, and 5f, the right first antenna of most male specimens ends in a sharp point. However, several specimens had another segment beyond this point (Figs. 5i, k) and one male *T. mayumbaensis* had two segments beyond this point (Fig. 5h). Apparently the last one or two segments are easily broken off. Scott (1894, Pl. 8, Fig. 48) figured two segments beyond the sharply pointed segment for male *T. mayumbaensis*, as did Legaré (1964, Pl. 3, Fig. 12a). The total number of segments noted for the *T. minor* male right first antenna is thus 19, for the *T. mayumbaensis* male 20. The male left first antenna has been broken on all specimens examined. Figure 4a shows a male left first antenna with 18 segments, the last one or more segments broken off.

The male fifth legs (Figs. 5b-e) as well as the female's, are slimmer than those of the *T. mayumbaensis* male (Fig. 5a). The right fifth leg consists of a short first segment with a fat inner distal spine visible in lateral view (Fig. 5c), a long second segment, and a long curved distal spine, notched near the base with a small secondary spine (Fig. 5b). The left fifth leg consists of three segments, the second and third indistinctly separated in some views. The first segment has on its inner distal side a fat curved spine, and on its anterior distal side bears a long curved spine, which in some views is seen to have a clear break near the tip (Figs. 5d, e) and to be finely toothed over the center third of its length. The third segment is relatively long and slim in most views, ending bluntly distally, quite unlike this segment in the *T. mayumbaensis* male, which is wide and notched at the tip (Fig. 5a). In some views a transparent swelling protrudes from the third segment (Fig. 5d).

The short caudal rami each have two stout setae, the longer of which is 0.3 mm long (Fig. 1d).

Size: 0.60–0.62 mm total length.

Remarks: Both sexes of *T. minor* may be distinguished from *T. mayumbaensis* by the shape of the rostrum (compare Figs. 1e and f with 1g and h). In the female the symmetrical genital segment and the fifth legs with the long endopodite (?) filament, longer than the third segment, are easily observed. As noted and/or figured by Farran (1936), Grice (1962) and Wheeler (1970), the female *T. mayumbaensis* genital segment has a spine on the left side (Figs. 2e, f), which is lacking on the *T. minor* female genital segment. Also the *T. mayumbaensis* female genital segment is asymmetrical, more swollen on the right side (Figs. 1a, 2e), and the female fifth legs are asymmetrical, the right leg being larger and wider, and the rudimentary endopodite (?) filament is not forked and not longer than the notched third segment.

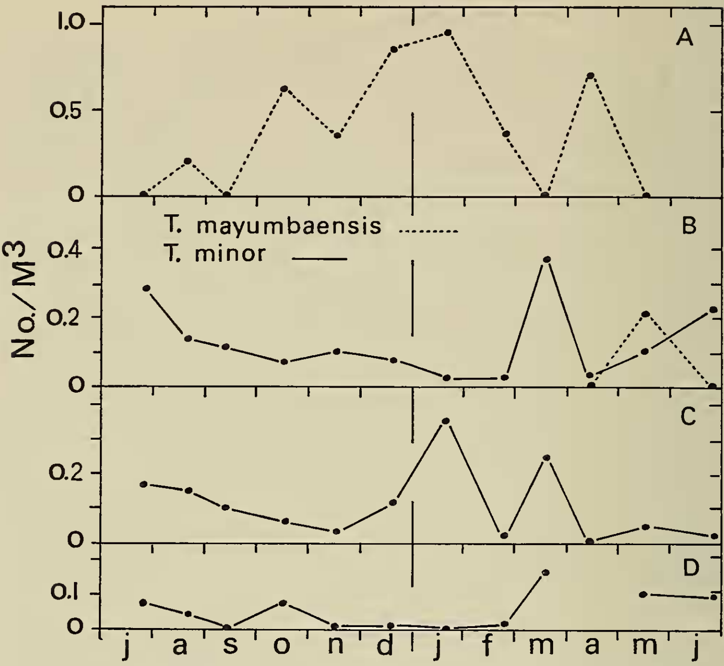

Fig. 6. Numbers per cubic meter from July 1968 to June 1969 of *T. mayumbaensis*, dotted line, and *T. minor*, solid line, for A, 0–500 m; B, 500–1,000 m; C, 1,000–1,500 m; D, 1,500–2,000 m.

It appears to be characteristic of *Temoropia* that the antennae, leg segments and caudal setae are broken off from specimens that otherwise are in good condition. The fifth legs are invariably present, the first legs usually intact, but the exopodite segments in particular of the other legs are usually missing. The female first antenna has apparently never been found intact on either species, although Scott (1894) assumed that in *T. mayumbaensis* females there were probably 22 or 23 segments. Farran (1908) also noted that the antennae and leg segments were missing from his specimens. Fortunately the diagnostic characters that most easily separate the two species, the shape of the rostrum and female genital segment and the fifth legs, are always intact.

At Station "S" female *T. mayumbaensis* are 0.85–0.95 mm long, males 0.78–0.80 mm long. Other reported lengths for females are 0.93 (T. Scott, 1894), 0.94–0.99 mm (Grice, 1962), 0.94 (A. Scott, 1909), 0.70–0.92 mm (Farran, 1936), and 0.990–1.045 mm (Vervoort, 1965), and for males 0.93 mm (Scott, 1894), 0.88–0.92 mm (Grice, 1962), 0.90 mm (Scott, 1909), and 0.84 mm (Farran, 1936). At Station "S", all *T. minor* females are around 0.7 mm long, males around 0.6 mm in length. Farran's (1908, 1929) females were 0.72–0.80 mm long.

Vertical Distribution of the Two Species

At Station "S" *T. mayumbaensis* has been the only species observed in samples collected in the upper 500 m, and some specimens have been found in samples from the 500–1,000 m depth interval. *T. minor* has been present in almost all of the samples collected between 500 and 2,000 m. Figure 6 shows the total numbers/m^3 of the two species over the four depth intervals, 0–500 m, 500–1,000 m, 1,000–1,500 m, and 1,500–2,000 m, for the year from July 1968 to June 1969. *T. mayumbaensis* had a winter maximum and summer minimum in the upper 500 m (Fig. 6A). *T. minor* was most numerous between 500 and 1,500 m depths, with highest numbers in March between 500 and 1,000 m (Fig. 6B), and in January and March between 1,000 and 1,500 m depths (Fig. 6C). Although the numbers/m^3 are quite small, ranging up to 0.36/m^3 for T. minor, up to 71 specimens/sample were counted; 702 specimens of *Temoropia* were counted in obtaining the numbers/m^3 illustrated in Figure 6.

Since both species have been obtained in deep-water plankton samples on a number of occasions, it is obvious that *Temoropia* is not confined to the upper 500 m. At Station "S" *T. mayumbaensis*, which occurs only in small numbers, is a much less likely contaminant of deep-water samples than the smaller and much more numerous species of *Calocalanus* or *Farranula*, for example. *T. mayumbaensis* is most numerous in the upper waters, but may occur in small numbers below 500 m. *T. minor* has thus far been found only below 500 m at Station "S", and some undocumented reports of *T. mayumbaensis* in deep-water samples may refer to this species. However, this is not the case with Wheeler's samples, since he found both species in closing-net samples from 2,000–4,000 m. Possibly contamination of the deepest plankton tows may occur when the nets pass through the sparsely populated intermediate depths.

Geographical Distribution

The genus *Temoropia* has been recorded from the Atlantic, Pacific, and Indian Oceans, the Mediterranean and Adriatic Seas. *T. minor* is now known from the North Atlantic and the South Pacific off New Zealand, documented *T. mayumbaensis* from the Atlantic and Pacific Oceans.

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